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IS : 12449 (Part 2) - 1988
(Reaffirmed 1993)

Indian Standard

SPECIFICATION FOR STARTING DEVICES (OTHER THAN GLOW STARTERS)

PART 2 PERFORMANCE REQUIREMENTS

(First Reprint DECEMBER 1997)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4 *April* 1989

AMENDMENT NO. 1 MAY 2002
TO
IS 12449 (PART 2) : 1988 SPECIFICATION FOR STARTING DEVICES (OTHER THAN GLOW STARTERS)
PART 2 PERFORMANCE REQUIREMENTS

(*Page* 6, *clause* 6.2.5, *para* 2) — Insert the following Note at the end:

'NOTE — As an alternative to the electrostatic voltages prescribed in Fig. 1, a memory oscilloscope may be used in the circuit together with a high voltage probe having the following properties:

Input resistance	≥	100 Mohm
Input capacitance	≤	15 PF
Cut-off frequency	≥	1 MHz

In case of doubt, the measurement with the electrostatic voltmeter shall be the reference method.'

[*Page* 8, *clause* 7.1(n) *and* (p)] — Substitute 'Part 2' *for* 'Part 1' at both the places.

(ET 23)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SPECIFICATION FOR STARTING DEVICES (OTHER THAN GLOW STARTERS)

PART 2 PERFORMANCE REQUIREMENTS

0. FOREWORD

0.1 This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards on 24 June 1988, after the draft finalized by the Electric Lamps and Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 In the prepartion of this standard, assistance has been taken from IEC Document 34C (Central Office) 148 Starting devices (other than glow starters) — Performance requirements.

0.3 For the purpose of deciding whether a particular requirement of the standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS : 2-1960* The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part 2) specifies performance requirements for starting devices (starters and ignitors) for tubular fluorescent and other discharge lamps for use on ac supplies up to 1 000 V at 50 Hz which produce starting pulses not greater than 5 kV.

1.2 It should be read in conjuction with Part 1 of this standard.

NOTE — All glow starters for fluorescent and other discharge lamps including thermal relay/cut-outs are included in IS : 2215-1984*.

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*Specification for starters for fluorescent lamps (*third revision*).

SECTION 1 GENERAL REQUIREMENTS AND DEFINITIONS

2. DEFINITIONS

2.0 The definitions of Part 1 of this standard apply together with the following.

2.1 Starter with Mechanical Switching Element — A starter which provides cathode preheating current and lamp starting pulse(s) by mechanical means (for example, thermal or magnetic).

2.2 Starter with Electronic Switching Element — A starter which provides cathode preheating current and lamp starting voltage(s) or pulse(s) by electronic means and contains no moving parts.

2.3 De-activated Lamp — A lamp in which one or both cathodes are deprived of emitting material but neither of which is broken.

2.4 Non-Re-operating Level — A reduced level of voltage and/or current at which a starting device should not re-operate after the completion of the starting cycle, and the lamp is operating normally.

2.5 Maximum Abnormal Current — The value of continuous rms current through the ballast which should not be exceeded at the end of the starting cycle when the circuit is in an abnormal condition (for example, de-activated lamp, lamp has been removed).

2.6 Starting Aid — A starting aid can be either a conductive strip affixed to the outer surface of a lamp or a conductive plate which is spaced within an appropriate distance from a lamp.

A starting aid can only be effective when it has an adequate potential difference from one end of the lamp.

3. GENERAL REQUIREMENTS FOR TESTS

3.1 Unless otherwise specified, the tests shall be made at an ambient temperature between 10 and 30°C.

The tests shall be carried out in the order of the clauses.

The following number of samples shall be submitted:

a) Six samples of starters as defined in **2.1** and **2.2**; and

b) Two samples of ignitors (where appropriate together with those circuit components which are necessary to carry out the tests).

3.2 Supply Voltage — The total harmonic content of the supply voltage shall not exceed 3 percent, the harmonic content being defined as the root-mean-square (rms) summation of the individual harmonic components, using the fundamental as 100 percent.

Care shall be taken that this applies under all conditions that occur during the measurement.

NOTE — This implies that the source of supply will have sufficient power and that the supply circuit has sufficiently low impedance at supply frequency and impulse frequency compared with the ballast impedance.

The correct impedance at impulse frequency can be obtained by connecting a 2 μF (approx) capacitor in parallel with the source.

3.3 All starting devices specified in this standard shall meet the requirements of Part 1 of this standard.

4. MARKING

4.1 The marking requirements specified in Part 1 of this standard shall apply, together with the following to be either clearly marked on the starting device or made available in the manufacturers catalogue or the like:

a) The manufacturer shall declare the type of switching element as defined in **2.1** and **2.2**; and

b) The manufacturer shall declare the maximum load capacitance for satisfactory operation of the ignitor.

SECTION 2 PERFORMANCE REQUIREMENTS FOR STARTERS (OTHER THAN GLOW STARTERS) FOR FLUORESCENT LAMPS

5. TESTS FOR PERFORMANCE REQUIREMENTS FOR STARTERS (OTHER THAN GLOW STARTERS) FOR FLUORESCENT LAMPS

5.1 The following clauses specify performance requirements for starters other than glow starters, used with tubular fluorescent lamps with preheated cathode, and their associated ballasts [*see* IS : 1534 (Part 1)-1977* and IS : 2418 (Part 1)-1977†, where appropriate].

5.2 Starting Test

5.2.1 *Starting Test Quantity* — The starting test quantity shall consist of six new starters which have not been subjected to the tests specified in Part 1 of this standard.

5.2.2 *Conditions of Acceptance* — The type shall be considered as satisfying the requirements of this clause if all six starters comply with the appropriate tests specified in **5.2.4** and **5.2.8**. If one failure occurs, a further six starters shall be selected and tested, and all these shall comply. If more than one failure occurs the starter is deemed not to satisfy the requirements of this clause.

5.2.3 *Conditions of Test*

5.2.3.1 *Circuit* — The starter shall be tested in the circuit declared by the manufacturer.

A starting aid complying with the requirement of Table 1 shall be used, unless otherwise indicated on the starter or in the manufacturer's literature.

TABLE 1 STARTING AID REQUIREMENTS

LAMP DIAMETER (mm)	STARTING AID WIDTH (mm)	SPACING FROM LAMP (mm)	LENGTH
(1)	(2)	(3)	(4)
15	25	7	Not less than lamp length
25	40	12	
38	40	20	
15/25/38	1·5	0*	

*Strip affixed to lamp surface.

NOTE — A starting aid spaced from the lamp can only be effective if the outer surface of the lamp is treated to be non-wetting.

In case of doubt, a choice shall be made in mutual agreement between testing authority and manufacturer.

5.2.3.2 *Ballast* — The ballast used shall meet the requirements of relevant Indian Standards, where appropriate. It shall have a rated voltage equal to the supply voltage or equal to the lowest value of the supply voltage range for which the starter is designed.

The rated wattage of the ballast shall be chosen to give the most onerous starting

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*Specification for ballasts for fluorescent lamps: Part 1 For switch start circuits (*second revision*).

†Specification for tubular fluorescent lamps for general lighting service: Part 1 Requirements and tests (*first revision*).

conditions of the range of lamp types for which the starter is designed. In case of doubt, the rated wattage of the ballast shall correspond to the main lamp type for which the starter is designed.

Where a starter is designed to operate with different ballast types (for example, capacitive or inductive), this test shall be made with both types of ballasts.

5.2.3.3 *Lamps* — The lamp shall be of the pre-heated cathode type and, where appropriate, meet the requirements of IS : 2418 (Part 1)-1977*. The rated wattage of the lamp shall be equal to the rated wattage of the ballast used.

For starters of the mechanical type defined in **2.1**, the lamp shall normally be of the 'with starter' type.

For starters of the electronic type defined in **2.2**, the lamp shall normally be of the 'starterless' type.

Where a choice of lamp of 'with starter' or 'starterless' type is delcared by the manufacturer, the 'with starter' type shall be used.

5.2.4 *Starters Having a Mechanical Switching Elements*

5.2.4.1 *Speed of operation*

a) *Current operated starters* — A current equal to the minimum pre-heating current prescribed on the relevant lamp data sheet in IS : 2418 (Part 2)-1977* shall be passed through the circuit.

For starters which incorporate a cut-out, the starter shall operate at least once during the test period of 30 seconds. For continuously operating starters, the starter shall operate at least twice during the test period of 30 seconds.

The test shall be made with a de-activated lamp or with an equivalent resistance of both cathodes in series as prescribed on the relevant lamp data sheet in IS : 2418 (Part 2)-1977*.

b) *Voltage operated starters* — A voltage of 0 92 times the rated voltage of the ballast shall be applied to the circuit.

For starters which incorporate a cut-out, the starter shall operate at least once during the test period of 30 seconds.

For continuously operating starters, the starter shall operate at least twice during the test period of 30 seconds.

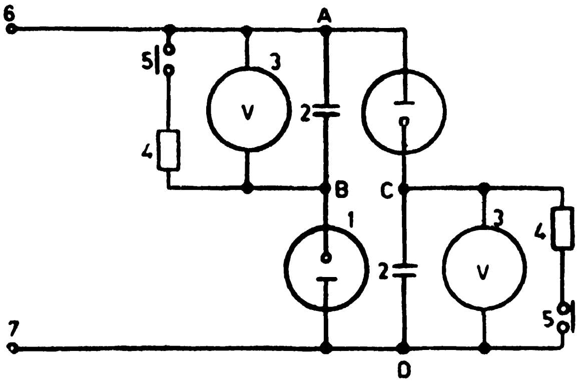
The test is made with a de-activated lamp or with an equivalent resistance of both cathodes in series as prescribed on the relevant lamp data sheet in IS : 2418 (Part 2)-1977*.

5.2.4.2 *Cathode pre-heating* — A voltage of 0·92 times the rated voltage of the ballast shall be applied to the circuit.

Starters shall provide sufficient lamp cathode heating. The preheating current shall be either as specified on the relevant lamp data sheet in IS : 2418 (Part 2)-1977* or shall be in line with lamp manufacturer's requirements relating to current and time.

5.2.4.3 *Pulse voltage* — The circuit for measuring pulse voltage shall be as shown in Fig. 1.

a) *Circuit*



b) *Components*

1. *HV diode*

Blocking voltage	$U_{RM} > 25$ kV
Rated current	$I_{FAVM} > 1·5$ mA
Periodical peak current	$I_{FRM} > 0 1$ A
Anode/Cathode capacitance	$C_a/k < 2$ PF

NOTE — Suitable parts are, for example, HV rectifier tubes type GY 501 for CTV receivers.

2. *HV capacitor*

Capacitance	$C = 500$ pF
Rated voltage	$U > 6·3$ kV
Phase-angle difference (at 10 kHz)	$\tan \delta = 20 \times 10^{-8}$

3. *HV measuring instrument*

Static voltmeter	0 to 6 kV
Capacitance at full deflection	15 pF
Breakdown voltage	10 kV
Precision	Class 1 or better

4. *Discharge resistance* 1 MΩ

5. *Short-circuiting device for discharging*

6. *To high-voltage lead of ignitor*

7. *To neutral conductor*

NOTE — The leakage resistance between *A* and *B*, and between *C* and *D* shall be not less than 10^{13} Ω.

FIG. 1 STARTING VOLTAGE MEASUREMENT FOR IGNITORS

A voltage of 0·92 times the rated voltage of the ballast shall be applied to the circuit for 30 seconds. On at least one occasion during this period, the highest pulse voltage (indicated by either of the two voltmeters) shall be not less than the value mentioned in the column 'information for starter design' of the relevant lamp data sheet of IS : 2418 (Part 2)-1977*. If the starter is designed for a range of lamps, care should be

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*Specification for tubular fluorescent lamps for general lighting service:
Part 1 Requirements and tests (*first revision*).
Part 2 Standard lamp data sheets (*first revision*).

*Specification for tubular fluorescent lamps for general lighting service: Part 2 Standard lamp data sheets (*first revision*).

taken that the highest voltage value quoted in the sheets for the lamps within that range should be used.

5.2.5 *Starters Having an Electronic Switching Element*

5.2.5.1 *Speed of operation* — A voltage of 0·92 times the rated voltage of the ballast shall be applied to the circuit.

For starters which incorporate a cut-out, the starter shall operate at least once during the test period of 30 seconds.

For continuously operating starters, the starter shall operate at least twice during the test period of 30 seconds.

The test is made with each lamp cathode replaced by a resistance corresponding to the objective value as prescribed on the relevant lamp data sheet in IS : 2418 (Part 2)-1977*.

5.2.5.2 *Cathode pre-heating* — Requirements are under consideration.

5.2.5.3 *Starting voltage* — A voltage of 0·92 times the rated voltage of the ballast shall be applied to the circuit for 30 seconds.

Further details are under consideration.

5.2.5.4 *Alternative assessment of lamp starting conditions* — As an alternative to the measurements of 5.2.5.1, 5.2.5.2 and 5.2.5.3 a lamp-life test may be substituted by mutual agreement between lamp manufacturer and test authority.

Lamp-life test method and requirements are under consideration.

5.2.6 *Non-re-operating Level* — This applies to starters with mechanical and electronic switching elements.

With a circuit and rated ballast as previously specified but with a lamp connected as in normal use, the following test shall be applied.

5.2.6.1 *For voltage operated starters* — A supply voltage equal to the rated voltage of the ballast shall be applied to the circuit and the lamp shall start and operate normally.

After a period of 30 seconds lamp operation, the supply voltage shall be reduced within 5 seconds without interruption to 85 percent of the rated value and held in this condition for 90 seconds. The lamp shall remain alight without disturbance from the starter.

5.2.6.2 *For current operated starters* — A supply voltage equal to the rated voltage of the ballast shall be applied to the circuit and the lamp shall start and operate normally.

After a period of 30 seconds lamp operation the lamp current shall be reduced within 5 seconds without interruption to a value which shall be 80 percent of the nominal lamp running current as prescribed on the relevant lamp data sheet given in IS : 2418 (Part 2)-1977*. This condition is held for 90 seconds.

The lamp shall remain alight without disturbance from the starter.

5.2.7 *Maximum Pre-heat Current* — In order to protect lamp cathodes against excessive pre-heating current, if a healthy lamp fails to start, the following test shall be applied to starters with mechanical and electronic switching elements. With the starter connected as for normal operation and with a supply voltage equal to 106 percent of the ballast rated voltage applied to the circuit, the effective rms current through the ballast during the 60 seconds period immediately after switch-on is measured. During this period, the pre-heating current may rise as high as 2·1 times the nominal running current for a maximum duration of 1 second, provided the average rms values over 60 seconds do not exceed 115 percent of the nominal running current as prescribed on the relevant lamp data sheet given in IS : 2418 (Part 2)-1977*.

For this test, a de-activated lamp or two separate lamp ends with real cathodes shall be used.

5.2.8 *Interruption of Starter Function* — If the starter contains elements that, in case of pre-heating the lamp cathodes and at 106 percent of the rated voltage, would increase the current through the ballast to a value that exceeds the value arising from short-circuited starter connections, the starter shall comprise an additional cut-out that limits this current within 5 minutes to maximum 115 percent of the rated lamp current.

5.3 Endurance Test

5.3.1 *Test Quantity* — The test quantity shall consist of 3 starters which have passed the tests of 5.2.

5.3.2 *Test Conditions* — For this test, the starters are connected, as in normal use, operated at the maximum case temperature to and associated with a lamp of the highest wattage rating for which the starter is intended together with an appropriate ballast. The ballast shall conform with the requirements of Appendix A. The test voltage shall be equal to the rated voltage of the ballast.

In the event of the lamp failing during this test, arrangements shall be made for its immediate replacement.

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*Specification for tubular fluorescent lamps for general lighting service: Part 2 Standard lamp data sheets (*first revision*).

*Specification for tubular fluorescent lamps for general lighting service: Part 2 Standard lamp data sheets (*first revision*).

5.3.3 *Starters Replaceable Without Tools* — The test duration shall be 6 000 cycles, each of 4 minutes. During each cycle, the voltage shall be applied to the circuit for 90 ± 30 seconds.

A test period of 30 minutes shall be applied during each 12 h testing.

5.3.4 *Starters not Intended for Replacement* — The test duration shall be 25 000 cycles, each of 1 minute. During each cycle, the voltage shall be applied to the circuit for 90 × 30 seconds.

A test period of 30 minutes shall be applied during each 12 h testing.

5.3.5 *Conditions of Acceptance* — After this test, the tests in 5.2.4 to 5.2.7 shall be repeated.

In the event of one starter failing to comply, another 3 shall be tested, all of which shall comply.

5.4 De-activated Lamp Test

5.4.1 *Test Quantity* — The test quantity shall consist of 3 starters which have passed the test in 5.2 but not having been used for the test in 5.3.

5.4.2 *Test Conditions* — In this test, the starters are connected as in normal use and except for 5.4.5 operated at the maximum case temperature t_c and associated with appropriate lamps having de-activated cathodes. A lamp of the highest wattage rating for which the starter is intended shall be used together with an appropriate ballast.

The ballast shall comply with the requirements of Appendix A.

The test voltage shall be equal to the rated voltage of the ballast.

It is permissible to use a substitution resistor in place of each lamp cathode. The value of each resistor shall be the objective value as prescribed on the relevant lamp data sheet given in IS : 2418 (Part 2)-1977*.

5.4.3 *Starters with a Mechanical Switching Element but Without Cut-Out*

After 3 hours continuous operation, the starter shall be subjected to the appropriate tests described in 5.2.4 to 5.2.7.

After a further 5 hours continuous operation, neither the switching contacts shall have welded together nor shall the capacitor have failed.

5.4.4 *Starters with an Electronic Switching Element but Without Cut-Out* — Starters replaceable without tools shall be subjected after 8 hours continuous operation to the appropriate tests described in 5.2.4 to 5.2.7.

Starters not intended for replacement shall be subjected after 40 hours continuous operation to the appropriate tests described in 5.2.4 to 5.2.7.

5.4.5 *Starters with a Mechanical Switching Element and with Thermal Cut-Out* — Starters are tested in a cycle of 5 minutes ON and 10 minutes OFF at the minimum and maximum temperature of − 20°C and +80°C, unless the manufacturer has specified a different temperature range.

Only the starter is subjected to these temperature, the lamp and ballast shall remain at ambient temperature.

During 5 minutes ON period, the cut-out shall become operative. Resetting shall not take place by itself.

Starters with manually reset cut-outs shall be subjected 20 times to the test described above.

Starters whose cut-outs are reset automatically, for example, by actuating the mains switch shall be subjected 500 times to the test described above.

After this test, the starter shall be subjected to the tests described in 5.2.4 to 5.2.7.

5.4.6 *Starters with an Electronic Switching Element and Electronic Cut-Out* — Starters shall be subjected to a test cycle of 4 minutes. During each cycle, the test voltage shall be applied for 90 ± 30 seconds.

Alternatively, the test cycle may be mutually agreed between the testing authority and the manufacturer.

The total test cycling period shall consist of at least 500 complete cycles and the cut-out shall operate during every ON period.

At the end of the test cycling period, the starters shall be subjected to the appropriate tests given in 5.2.4 to 5.2.7.

5.4.7 *Condition of Acceptance* — In the event of one starter failing to comply with the appropriate tests in 5.4.3 to 5.4.6, a further test quantity shall be tested, all of which shall comply.

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*Specification for tubular fluorescent lamps for general lighting service: Part 2 Standard lamp data sheets (*first revision*).

SECTION 3 PERFORMANCE REQUIREMENTS FOR IGNITORS

6. TESTS FOR PERFORMANCE REQUIREMENTS FOR IGNITORS

6.1 The following clauses specify performance requirements for ignitors used with low pressure and high-pressure sodium vapour lamps and metal halide lamps, and should be used in conjunction with the corresponding publication for these lamps and their ballasts.

6.2 Starting Test

6.2.1 The test shall be made on two ignitors that have not been submitted to any other test.

6.2.2 *Test Conditions* — In this test, the ignitors are connected as in normal use.

Ignitors are tested in combination with lamps and ballasts for which the ignitor is intended. For ignitors intended for more than one lamp type or lamp wattage ratings, it may be necessary to make the test for each lamp type of each wattage rating.

The ballast used shall meet the requirements of the relevant Indian Standard and be compatible with the lamp type or wattage to be started by the ignitor.

6.2.3 *Condition of Acceptance* — The type complies with the requirements in this section, when both ignitors comply with the tests specified in **6.2.4** to **6.2.7**.

If one ignitor fails any test, another two ignitors shall be tested and both shall comply.

6.2.4 *Switching Speed* — A voltage of 0·92 times the rated supply voltage shall be applied to the circuit.

During a period of 30 seconds, the starting operation shall take place at least once. The test is made without a lamp.

6.2.5 *Pulse Voltage* — To measure the pulse voltage, the ignitor is connected in accordance with **6.2.2** but without lamp, using the circuit shown in Fig. 1.

Within the rated temperature range (if any) and with a maximum load capacitance of 1 000 pF (unless otherwise declared by the manufacturer) and at 0·92 times the rated supply voltage, the pulse voltage available at the lamp (generated by ignitor or ignitor-ballast combination) shall be not less than the value declared by the manufacturer.

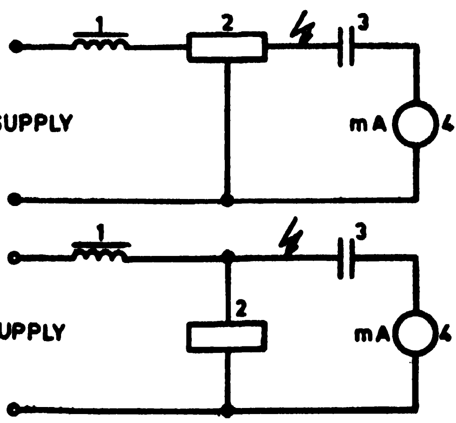
6.2.6 *Repetition Rate, Pulse Position, Width and Height of Starting Pulse for Triggered Ignitors* — Details are under consideration.

The test shall be made aided by an oscilloscope and a high-voltage probe. Properties required for this combination are:

Input resistance	100 MΩ
Input capacitance	5 pF
Cut-off frequency	50 MHz

6.2.7 *Ignition Energy for Non-triggered Ignitors* — The ignition energy of non-triggered ignitors shall be measured in the circuit of Fig. 2. Required values are under consideration.

a) *Circuit*



b) *Components*

1. Choke
2. Ignitor under test
3. Blocking capacitor

Capacitance	0·1 F
Tolerance on capacitance	± 5 percent
Rated voltage	1 000 V
Phase-angle difference (at 10 kHz)	tan 20 × 10^{-8}
Pulse loading capacity	100 V/s

4. Current measuring instrument suitable for high frequency

Current range	0 to 150 mA
Indication error at full deflection	< 3 percent
Internal resistance of measuring instrument	$R_i \leqslant 10$

FIG. 2 IGNITION ENERGY MEASUREMENT FOR NON-TRIGGERED IGNITORS

For ignitors for low-pressure sodium lamps, both the circuit and values are under consideration.

6.3 Non-re-Operation Level — Ignitors shall not operate after the lamp has started.

Two ignitors complying with the test of **6.2** shall be subjected to the following test:

> A lamp compatible with the ignitor is connected as in normal use, started and operated until stabilization.

For ignitors whose function depends on the lamp voltage, the supply voltage is reduced continuously down to 85 percent of the rated supply voltage without breaking the supply circuit.

The current flowing through the ignitor circuit after 1 min shall not exceed the rated lamp current (for ballast protection) and there shall be no disturbance of the lamp function.

For ignitors whose function depends on the lamp current, the lamp current is reduced continuously down to 80 percent of the rated lamp current without breaking the supply circuit.

The current flowing through the ignitor circuit after 1 minute shall not exceed the rated lamp current (for ballast protection) and there shall be no disturbance of the lamp function.

This test is not made if, according to the manufacturer, the ignitor in addition to the starting function performs other functions necessary for the appropriate operation of the lamp.

However, in case of a defective lamp, the current flowing through the ignitor circuit after 1 min shall not exceed the rated lamp current.

6.4 Endurance Test

6.4.1 *Test Quantity* — The test quantity shall consist of two ignitors that have passed the tests of **6.2** and **6.3** (as appropriate).

6.4.2 *Test Conditions* — In this test, the two ignitors are connected as in normal use, associated with an appropriate ballast. The test voltage shall correspond to 1·06 times the rated supply voltage of the ballast. The ignitors are operated in conformity with their marking at the maximum allowable temperature and without lamp. In doing so, the live connections of one of the ignitors are loaded by the maximum allowable load capacitance whilst the connections of the other ignitors are left unloaded.

The ballast used in the life test shall comply with the requirements specified in Appendix A. Ballasts that fail during the endurance test are replaced.

6.4.3 *Ignitors without Replaceable Switching Elements* — After 30 days (720 h) continuous operation, the ignitor shall be subjected to the tests described in **6.2.4** to **6.2.7** and **6.3**.

6.4.4 *Ignitors with Switching Elements Replaceable without Tools* — After 30 days (720 h) continuous operation, the ignitor shall be subjected to the tests described in **6.2.4** to **6.2.7** and **6.6**.

Switching elements that fail during this test are replaced up to six times. The test is regarded as completed when seven switching elements have failed.

After these tests and mounting of any new switching element, the ignitor shall be subjected to the tests described in **6.2.4** to **6.2.7** and **6.3**.

6.4.5 *Ignitors with Additional Cut-Outs* — The ignitor is operated at rated supply voltage without lamp each time at a temperature of −20°C and +80°C, unless the manufacturer has specified a different temperature range.

The cut-out shall become operative within 5 minutes.

Ignitors with manually reset cut-outs shall be subjected 20 times to the test described above.

Starters whose cut-outs are reset automatically, for example, by actuating the mains switch, shall be subjected 500 times to the test described above.

After these tests, the ignitor shall be subjected to the tests described in **6.2.4** to **6.2.7** and **6.3**.

6.4.6 *Conditions of Compliance* — The type complies with the requirements of this section, if all ignitors comply with the tests described in **6.2.4** to **6.2.7** and **6.3** after surviving the endurance test according to **6.4**.

In the event of one ignitor failing to comply, another two ignitors shall be tested, both of which shall comply.

6.4.7 Ignitors through which the lamp current flows shall be suitable for permanent load equivalent to the maximum allowable lamp current.

Also, the windings through which the lamp current flows shall be submitted to the endurance test according to IS : 1534 (Part 1)-1977*, based on the temperature and t_w correlations according to Indian Standard.

Instead of the impedance measurement, the peak voltage is measured as in **6.2.5** before and after the endurance test.

The changes in the values found shall not exceed ± 10 percent.

7. TESTS

7.0 Categories of Tests — Tests are classified as type, acceptance and routine tests.

7.1 Type Test — The following shall constitute type test:

a) Protection against accidental contact with live parts of independent starting device (*see* **7** of Part 1);

b) Resistance to dust and moisture (*see* **11** of Part 1);

c) Insultation resistance and electric strength (*see* **12** of Part 1);

d) Fault conditions (*see* **13** of Part 1);

e) Heating (of independent starting device) (*see* **14** of Part 1);

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*Specification for ballasts for fluorescent lamps: Part 1 For switch start circuits (*second revision*).

- f) Pulse voltage (*see* **15** of Part 1);
- g) Mechanical strength (*see* **16** of Part 1);
- h) Screws, current-carrying parts and connections (*see* **17** of Part 1);
- j) Creepage distance and clearances (*see* **18.1** of Part 1);
- k) Resistance to heat fire and tracking (*see* **19** of Part 1);
- m) Resistance to corrosion (*see* **20** of Part 1);
- n) Performance requirements for starter (other than glow starter) for fluorescent lamps (*see* **5** of Part 1); and
- p) Performance requirements for ignitions (*see* **6** of Part 1).

7.2 Acceptance Tests — Under consideration.

7.3 Routine Tests — Under consideration.

APPENDIX A

(*Clauses* 5.3.2, 5.4.2 *and* 6.4.2)

BALLASTS TO BE USED FOR LIFE TESTING

A-1. A ballast used for the life testing of starting devices shall comply with the following requirements.

A-1.1 It shall be of a type that will comply with the requirements of the relevant standard and corresponding with the starting conditions of the lamp.

A-1.2 When, at its rated voltage, it is associated with a lamp whose voltage at lamp terminals does not deviate by more than ± 2 percent from the objective value specified in the relevant standard (lamp standard), the lamp shall absorb a power which does not differ from its rated value by more than ± 4 percent.

A-1.3 a) For lamps with pre-heated cathodes, the pre-heating current (short-circuit current) at rated voltage shall not differ by more than ± 10 percent from the nominal value specified on the relevant lamp data sheet in IS : 2418 (Part 2)-1977*.

b) For lamps without pre-heated cathodes, the short-circuit current at rated voltage shall not deviate by more than ± 10 percent from the values specified in the relative sections of this Indian Standard. Ballasts for discharge lamps, performance requirements are under preparation.

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*Specification for tubular fluorescent lamps for general lighting service: Part 2 Standard lamp data sheets (*first revision*).

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